AD NUMBER

AD015749

NEW LIMITATION CHANGE

TO

Approved for public release, distribution unlimited

FROM

Distribution authorized to U.S. Gov't. agencies and their contractors; Administrative/Operational Use; Arp 1953. Other requests shall be referred to Hqs. Air Force Flight Test Center, Edwards AFB, CA 93523.

AUTHORITY

AFMC ltr 19 Feb 2002

UNCLASSIFIED

AD NUMBER
AD015749
CLASSIFICATION CHANGES
TO unclassified
FROM secret
AUTHORITY
AFFTC ltr 23 Jun 1955

THIS PAGE IS UNCLASSIFIED

15749

INITIALS
DATE

SECRET

CLASSIFIED SECURITY INFORMATION

AIR FORCE FLIGHT TEST CENTER

AIR RESEARCH & DEVELOPMENT COMMAND

TECHNICAL REPORT
NO. AFFTC 53-17

INVESTIGATION OF ENGINE OPERATIONAL DEFICIENCES IN THE F-86E AIRPLANE

OTHA J. CLARK, JR.
PROJECT ENGINEER

JUNE 1953

EDWARDS AIR FORCE BASE
EDWARDS, CALIFORNIA

CLASSIFIED SECURITY INFORMATION

SECRET

AF Technical Report No. AFFTC 53-17

PUBLICATION REVIEW

This Report has been reviewed and approved

Walter L. Moore Jr.

WALTER L. MOORE, JR.
Lt Colonel, USAF
Director, Flight Test
and Development

J. S. Holtoner

J. S. HOLTONER
Brigadier General, USAF
Commander

AF Technical Report No. AFFTC 53-17 April 1953

INVESTIGATION OF ENGINE OPERATIONAL DEFICIENCIES IN THE F-86E AIRPLANE

OTHA J. CLARK, JR.
Project Engineer

UNITED STATES AIR FORCE
AIR RESEARCH AND DEVELOPMENT COMMAND
AIR FORCE FLIGHT TEST CENTER
Edwards, California

A B S T R A C T

Flight tests conducted to investigate reported unsatisfactory engine operation in the F-86E airplane disclosed that erratic fuel regulation was caused by deficiencies in the oil system. A slight plumbing modification was evaluated and recommended as a fix. Further investigation of high oil consumption and inadequate scavenging indicated that recognized lubrication system problems can become critical on the F-86E airplane because of its smaller oil tank.

TABLE OF CONTENTS

HEADQUARTERS
AIR FORCE FLIGHT TEST CENTER
EDWARDS AIR FORCE BASE
Edwards, California

INVESTIGATION OF ENGINE OPERATIONAL DEFICIENCIES

IN THE F-86E AIRPLANE

A. PURPOSE:

1. This report presents the results of a test program which was conducted to investigate and correct unsatisfactory engine operation at altitude in the F-86E airplane.

B. SYNOPSIS OF TEST PROGRAM:

2. Introduction:

a. In April 1952, various combat units reported that severe deficiencies in engine operation were being encountered at high altitude in the F-86E airplane. The reported difficulties included failure to respond to throttle movements, flameouts, minor engine explosions, shroud ring seizures, low engine speed, and failures to obtain restarts after flameouts.

b. In May 1952, Headquarters, Air Research and Development Command, authorized the Air Force Flight Test Center to conduct the "F-86E Extreme Altitude Performance Test" to determine the causes of the unsatisfactory engine operation and to develop suitable modifications for eliminating the difficulties.

3. Test History:

a. The first phase of the test was conducted on a normal F-86E airplane and engine. The objective of this phase was to discover and isolate possible engine malfunctions at altitudes above 40,000 feet. Twelve flights were flown on two airplanes between 28 May and 30 June 1952. Data were recorded during various maneuvers and throttle manipulations at several altitudes and airspeeds, using both MIL-F-5624A (JP-4) and gasoline, but no unusual engine operation was encountered.

b. On 27 June, a conference was held at the Power Plant Laboratory, Wright Air Development Center, to disseminate all available information pertinent to the test and to formulate a more extensive test program. A review of the unsatisfactory reports indicated considerable diversity in the difficulties encountered, but apparently a fuel regulation deficiency was responsible for the most serious malfunctions. Consequently, the following course of action was planned: Adjustments were to be made to the fuel regulator to induce flameouts at high altitude; then experiments were to be conducted to determine a satisfactory method of eliminating the flameout characteristics.

c. An F-86A airplane was assigned for the second phase of the test. Complete instrumentation was installed and the first flight was flown on 9 September 1952. The airplane was then out of commission several weeks awaiting a new canopy. Meanwhile, an engine with a flameout history was received from FEAF. This engine was installed in the airplane with as few changes as possible, and sufficient flights were made to determine the cause for the flameouts.

d. The normal engine was reinstalled in the airplane for continuation of the test program. Again only one flight had been made when another faulty engine was received from FEAF. The information which accompanied this engine pointed to a different type of difficulty than had previously been reported: power losses, associated with high oil consumption and loss of oil pressure, had occurred after prolonged dives. Apparently the difficulty was peculiar to the F-86E airplane, so an F-86E was substituted for the F-86A test airplane. Testing on this vehicle extended from 18 December 1952 to 3 March 1953.

4. Test Results:

a. The exploratory tests conducted during the first phase disclosed no engine malfunction, and the test program planned for the F-86A airplane was interrupted before any results were obtained.

b. Many discrepancies were found on the first engine returned from FEAF. Several of these contributed to the unsatisfactory engine operation. Flameouts occurred almost every time an acceleration was attempted on this engine at altitude, and compressor stalls occurred during ground operation. These characteristics indicated the probability that the maximum fuel schedule was out of limits. A bench check of the main fuel regulator verified that the acceleration fuel flow was approximately 110% to 140% of the maximum prescribed value. Since this was ample cause for the flameouts and the general condition of the engine made it unsafe for flight, no further tests were made on this engine.

c. With the second faulty engine in the F-86E airplane, a power loss invariably occurred during prolonged climbs. Each power loss was preceded by a drop in oil pressure to zero. Oil consumption was excessive on each flight. Experiments soon disclosed that the oil tank was being emptied, resulting in air instead of oil being pumped into the main fuel regulator. Consequently, the regulator output pressure dropped, and since fuel pressure is proportional to the regulator output pressure, a drop in engine speed followed. The power loss problem was solved simply by changing the oil inlet line to the regulator to a different port (formerly unused) which permitted the regulator to draw its operating oil from its own internal supply rather than directly from the oil inlet port. The air pumped into the regulator was allowed to escape through the oil return line. This fix eliminated the power loss but did not affect the basic deficiency in the oil system.

d. Further investigation of the excessive oil consumption and the emptying of the oil tank soon disclosed that the turbine frame was defective. The mounting surface for the No. 4 bearing air-oil seal was warped, which caused the seal to wear out-of-round, resulting in excessive clearance. Air flow past the seal caused a pressure build-up inside the frame which forced oil vapor out the vents. Also, there was an extensive crack around the turbine frame inner weld just forward of the No. 4 bearing housing which permitted additional air flow across the No. 4 bearing sump. This condition apparently caused excessive foaming of the oil and resulted in oil starvation at the scavenge pump inlet. After the turbine frame was replaced it was impossible to induce zero oil pressure during flight, although oil consumption was still excessive when an over-size bearing seal was used.

C. CONCLUSIONS:

5. The blowouts encountered with the first faulty engine were caused by the altitude fuel schedule being considerably higher than the maximum limit. The numerous other discrepancies found on the engine and its poor condition in general contributed to its unsatisfactory performance. It is unlikely that this engine was representative of the F-86E engines in the combat theater; if it was, maintenance and inspection standards are not what they should be.

6. The power loss problem encountered on the second engine was caused by the pumping of air into the fuel regulator case because of a deficiency in the oil system; the combination of improper scavenging and the limited capacity of the tank in the F-86E airplane. A simple plumbing change at the fuel regulator eliminated the adverse effect caused by forcing air into the regulator. The poor aft section scavenging was caused by the cracked aft frame. The excessive oil consumption resulted from the over-size No. 4 bearing seal which wore out rapidly because of the warped aft frame.

7. Since cracked turbine frames are not unusual, the type of difficulty encountered with the second engine could account for a number of the reported malfunctions. The 5.7 gallon oil tank capacity of the F-86A airplane, compared to the 3.5 gallon capacity of the F-86E tank, would explain why the difficulty was peculiar to the F-86E airplane.

D. RECOMMENDATIONS:

8. It was recommended that the fuel regulator plumbing change be incorporated on F-86E engines to prevent erratic fuel regulation or power loss caused by depletion of the oil supply. Steps have been taken to effect this change.

9. Excessive engine oil consumption should be corrected by the normal repair or overhaul procedures.

APPENDIX I

I. TEST HISTORY:

A. The Air Force Flight Test Center conducted the "F-86E Extreme Altitude Performance Test" to determine the causes of and to develop suitable fixes for unsatisfactory high altitude engine operation in the F-86E airplane. The following table presents a condensed history of the test:

Phase No.	Date	Airplane	Engine	Flight Time
1	26 May 52	Test Request and Authorization received from ARDC.		
1	28 May 52	F-86E #51-2849	J47-GE-13 #046743	1:00
1	29 May to 11 Jun 52	Engine #067606 Installed.		
1	12 Jun to 30 Jun 52	F-86E #51-2848	J47-GE-13 #067606	12:15
2	1 Jul to 31 Jul 52	Meeting at WADC to discuss test and plan future program. Specific airplane assigned. Awaiting arrival of airplane.		
2	1 Aug to 8 Sep 52	After delay at WADC for maintenance, F-86A airplane, #47-616, arrived on 6 Aug. Instrumentation installed between 7 Aug and 8 Sep 52.		
2	9 Sep 52	F-86A #47-616	J47-GE-13 #046304	00:50
2	10 Sep to 1 Oct 52	Airplane out of commission awaiting new canopy. Faulty engine shipped from Korea was mis-sent to Tinker AF Base thence to Norton AF Base.		
3	2 Oct to 5 Nov 52	Faulty engine #042764 arrived at AFFTC on 2 October. Numerous discrepancies on engine had to be corrected before it could be flown.		
3	6 Nov to 20 Nov 52	F-86A #47-616	J47-GE-13 #042764	8:25
2	20 Nov to 14 Dec 52	Engine #046304 installed in airplane. Airplane maintenance work required.		
2	15 Dec 52	F-86A #47-616	J47-GE-13 #046304	1:20
4	16 Dec to 17 Dec 52	Second engine from Korea installed in F-86E airplane.		
4	18 Dec 52 26 Jan 53	F-86E #51-2849	J47-GE-13 #042042	10:25

Phase No.	Date	Airplane	Engine	Flight Time
4	27 Jan to 30 Jan 53	Engine #042042 removed for inspection. Normal engine installed.		
4	31 Jan to 5 Feb 53	F-86E #51-2849	J47-GE-13 #046918	3:25
4	6 Feb to 12 Feb 53	Engine #042042 inspected and reinstalled.		
4	13 Feb to 3 Mar 53	F-86E #51-2849	J47-GE-13 #042042	7:40

II. DISCUSSION OF TEST:

A. FIRST PHASE:

1. Objective:

a. Exploratory flights were made in an effort to locate an F-86E airplane which exhibited unsatisfactory engine characteristics similar to those reported by combat units.

2. Apparatus:

a. Two test support airplanes were used for the preliminary flights. F-86E airplane S/N 51-2849, with J47-GE-13 engine S/N 046743, was used for one flight; F-86E airplane S/N 51-2848, with J47-GE-13 engine S/N 067606, was used for eleven flights. The latter engine had previously been removed from flight status for an investigation because of reported fuel pressure fluctuations and engine speed variations at an altitude of 42,000 feet.

3. Procedure and Results:

a. Prior to installation of engine S/N 067606, the fuel system components which might have been responsible for the fuel fluctuations were tested on the flow bench. Two discrepancies were found: fuel flow through the flow divider was slightly higher than allowable under conditions corresponding to high altitude operation, and the fuel flow control valve chattered at high pressures. These units were reinstalled on the engine without change.

b. Static engine runs were made prior to flight to obtain a calibration of throttle position versus engine speed; thus, the engine speeds obtained at given throttle settings during flight could be correlated with ground run data.

c. Flights were planned to simulate the conditions under which reported malfunctions had occurred. Throughout each flight the pilot reported data via radio to a recorder on the ground. Data were recorded during the following:

(1) Climbs at maximum rate at full throttle.

(2) Climbs at 97% engine speed.

(3) Level flight at various throttle settings at 2000 foot altitude increments from 40,000 to 48,000 feet.

(4) Turns at various speeds and bank angles at altitudes above 40,000 feet.

(5) Positive and negative acceleration maneuvers.

(6) Dives at various engine speeds and airspeeds.

(7) Normal and abrupt engine decelerations at altitudes above 40,000 feet.

(8) Incremental and full throttle-burst engine accelerations.

d. Both the main and emergency fuel systems were used. MIL-F-5624a (JP-4) fuel was used on all except one flight with gasoline.

e. In general the results were negative. Fuel pressure fluctuations ranging from 2 psi to 10 psi, and rarely up to 15 psi amplitude were encountered intermittently during the test program. Although the maximum fluctuations were greater than normal, they were not significant. No flameout tendencies were encountered and engine operation was normal in all other respects.

4. Conclusions:

a. It was concluded that a very extensive program would probably be required to isolate an engine which exhibited the desired symptoms. A more direct program was planned in which arbitrary malfunctions would be corrected by various methods.

B. SECOND PHASE:

1. Objective:

a. In order to expedite the test, adjustments were to be made to the main fuel regulator to induce blowouts at high altitude. Experiments were then to be made with several proposed fixes to develop the most suitable method of eliminating the blowout characteristics.

2. Apparatus:

a. The F-86A airplane S/N 47-616, with J47-GE-13 engine S/N 046304, was assigned for this phase of the test. Sufficient instrumentation was installed on the engine to permit accurate analyses of engine operation during flight. Data were recorded by means of a camera and photopanel installed in the nose section of the airplane.

3. Procedure and Results:

a. Normal engine baseline data were to be accumulated first. Then fuel scheduling was to be modified to cause acceleration blowouts at high altitude. Various methods of eliminating the blowouts were then to be tested.

b. Only two baseline flights were completed since the arrival of two faulty engines from the combat theater caused the test program to be altered.

4. Conclusions:

a. No significant data were obtained during this phase.

C. <u>THIRD PHASE</u>:

1. Objective:

a. An engine which had been returned from the combat theater because of blowout difficulty was to be tested to determine and eliminate the cause of the blowouts. Other associated engine discrepancies were also to be investigated.

2. Apparatus:

a. The faulty J47-GE-13 engine, S/N 042764, was installed in the F-86A airplane S/N 47-616. To avoid the possibility of affecting the blowout characteristics the engine was altered as little as possible and no special instrumentation was provided for the early flights. Later the same instrumentation used for the second phase was installed.

3. Procedure and Results:

a. The engine was first to be tested exactly as received. However, an immediate inspection disclosed two discrepancies which had to be corrected. The turbine shroud ring was replaced because the old shroud ring had particles of metal, apparently deposited in a molten state, on its inner surface. Also, the connecting nut between the small slot fuel manifold and the No. 7 nozzle was cross-threaded to an extent that would have allowed a dangerous fuel leak.

b. When the engine was shut down after an initial ten-minute ground run, a large quantity of smoke emerged from the combustion chamber area. It was noticed that molten metal had accumulated in the vent holes on each side of the turbine frame. The engine was removed from the airplane for further inspection and it was found that a portion of the No. 4 bearing air-oil seal had melted away and the bearing rollers and race bore a number of bright longitudinal streaks. (These discrepancies are illustrated in Figures 1 through 3.) The turbine frame section had to be replaced since it was contaminated with metal particles. The aft oil system was flushed. Upon removal of the combustion chambers it was discovered that the inner cross-fire tubes between the No. 2 and No. 3 combustion chambers were missing. The discrepancies were corrected and the engine was reassembled and run in the test cell. Compressor stalls were encountered on burst accelerations from 70% and 50% engine speeds. Oil consumption was approximately 4½ pounds per hour.

c. The engine was reinstalled in the airplane. On the first run several compressor stalls were encountered during attempted accelerations, and on shutdown smoke came from the turbine frame breather line. The aft section of the engine was removed for another inspection of the No. 4 bearing seal. The No. 2 bearing seal and aft scavenge pump were also checked. Although no discrepancies were found this time, it was decided that the turbine frame should be replaced because of excessive oil consumption. Meanwhile the oil cooler was checked, and it was found that the oil temperature control valve was faulty. All oil by-passed the cooler even with an oil temperature as high as 140°F. A new thermostatic valve assembly was installed.

d. During the subsequent test cell run engine vibration in the horizontal plane at the forward frame ranged from .0035 to .0046 inches amplitude. Oil pressure went as high as 34 psi. Another compressor stall occurred when a burst acceleration was attempted from 60% engine speed. The compressor, forward bearing, and accessory gear section were inspected. The oil jet for the accessory drive pinion gear was plugged, accounting for the high oil pressure. There was evidence that the compressor rotor assembly aft of the tenth stage wheel had slipped radially relative to the section forward of the tenth stage. The amount of slippage was approximately 1/8 inch measured on the circumference of the spacer ring. Since it represented no hazard, this discrepancy was not corrected. The engine was reassembled for another cell run. Oil pressure was normal but engine vibration was unchanged.

e. Flight testing commenced. On the first two flights climbs were made at 97% and full engine speeds, followed by maneuvers and cautious throttle manipulations above 40,000 feet. On the third flight a blowout occurred on an attempted normal engine acceleration at 40,000 feet. On the next flight another blowout occurred on a normal throttle advance from approximately 85% engine speed. Because of the critical condition of the engine and the desire to obtain as much data as possible without altering the engine, no aerial restarts were attempted. Dead stick landings were made on the dry lake bed after blowouts.

f. The main fuel regulator and the fuel flow divider were removed and bench tested. The flow divider was satisfactory, but the regulator altitude schedule was above the maximum limit throughout the entire operating range as follows:

Reg. Sensing Pressure	Variable Control Oil (V.C.O.) Pressure		
	Limits		
	Max.	Min.	Actual
15 psia	46.2 psig	42 psig	59 psig
30 psia	71.7 psig	64 psig	94 psig
45 psia	111.0 psig	100 psig	141 psig
60 psia	160.0 psig	142 psig	187 psig
90 psia	251.0 psig	222.5 psig	267 psig

The regulator manual schedule was also well above the maximum limit. The regulator, VS-2-6900-G6 S/N 520A 1378, was returned to the General Electric Company for further investigation, and a serviceable regulator was installed on the engine.

g. Four additional flights were made with engine S/N 042764, using the new fuel regulator, and no flameouts could be obtained. The pilot reported increasing engine vibration on each flight. Since nothing further could be gained by continued testing on this engine, it was replaced by engine S/N 046304 to continue with the original program.

4. Conclusions:

a. The erroneous altitude fuel schedule was responsible for the high altitude blowouts and the compressor stalls. The numerous other discrepancies found on the engine contributed to its general unsatisfactory operation.

D. FOURTH PHASE:

1. Objective:

a. The cause of power losses at altitude experienced with engine S/N 042042 was to be determined, and a suitable method of eliminating the discrepancy was to be developed.

2. Apparatus:

a. The J47-GE-13 engine S/N 042042, the second faulty engine received from the combat theater, was tested in the F-86E airplane S/N 51-2849. At first no special instrumentation was installed, but after it was determined that the power loss was associated with a discrepancy in the oil system, instrumentation was installed to measure the following:

(1) Fuel regulator case oil temperature.

(2) Oil level in tank.

(3) Aft oil scavenge pump discharge pressure.

(4) Turbine frame breather line pressure.

3. Procedure and Results:

a. First, several flights were made to determine the conditions under which power loss occurred. During a full throttle climb on the first flight, engine oil pressure dropped to zero at 30,000 feet. Retarding the throttle restored the oil pressure. This cycle was repeated several times, and it was observed that engine speed fluctuated with the erratic oil pressure. On the next few flights it was determined that any prolonged climb would cause the oil pressure to drop to zero. The steeper the climb, the sooner the condition occurred. If the oil pressure was not restored immediately by leveling out or retarding the throttle, a sharp drop in engine speed followed. If no action was taken to restore the oil pressure it usually would return within 25 seconds, accompanied by a surge in engine speed. The zero oil pressure was induced also by imposing negative "g" loads on the airplane, but these conditions were normally of such short duration that fuel regulation was not affected. Oil consumption ranged from 4½ to 6 quarts per hour.

b. The complete loss of oil pressure suggested the probability that the oil tank was being emptied, causing the lube pump to pump air into the fuel regulator. It was suspected that this caused a drop in regulator output pressure which resulted in a corresponding drop in fuel pressure and engine speed. A mock-up of the system was tested on the flow bench to corroborate this theory. It was found that the regulator was not affected by shutting off the inlet oil, but injection of air into the oil inlet line caused a drop in regulator output pressure. A study of the regulator showed that the control oil pump in the regulator normally draws oil directly from the inlet line. By changing the oil inlet to the port (normally unused) directly above the V.C.O. port, any air pumped into the regulator case was allowed to escape through the adjacent oil return port on top of the regulator case. The regulator then continued to operate normally on its case oil supply. There was the possibility that this configuration might not afford sufficient changing of the oil to prevent overheating of the regulator, but this was found to be no problem. Figure 4 illustrates the modification.

c. To incorporate the regulator plumbing change on the engine it was necessary to remove one of the upper support channels from the power take-off ring assembly to provide clearance for the new line. A thermocouple was installed to measure the regulator oil temperature.

d. On subsequent flights no power loss was encountered, although the oil pressure still dropped to zero during climbs just as it had done previously. The zero oil pressure was maintained for periods as long as 80 seconds, and engine speed remained steady. The maximum regulator oil temperature recorded was 58°C.

e. After the power loss problem was eliminated, attention was focused on an investigation of the oil pressure loss and the excessive oil consumption. Catch cans were installed in the oil tank vent line and the turbine frame breather line. The maximum quantity of oil caught in the breather line can was approximately three quarts; none was caught in the other can. After most of the flights there was a large amount of oil inside the fuselage. It was determined that part of the oil was leaking from the drain valve in the oil inlet line at

No. 2 island on the engine. Apparently the spring loaded valve opened during maneuvers or when the oil pump was creating a negative pressure in the line because the tank was empty. The valve was replaced with a plug for the remainder of the test. There was also evidence on the early flights that an excessive amount of oil was escaping through the No. 2 bearing vents on each side of the engine.

f. When instrumentation was installed it was found that the turbine frame breather line pressure was slightly positive with respect to the ambient pressure. When adjustments of the aspirator line did not improve the condition, an F-86F type ejector pump utilizing engine compressed air for the primary air was installed in the breather line. Only a slight improvement in breather pressure was noted, but the amount of oil lost through the No. 2 bearing vents was apparently reduced. Upon first reaching full engine speed, the breather differential pressure was normal (approximately -6 in. H_2O), but after a few minutes of operation it became positive. Just after take-off under high ram conditions the differential reached a maximum of +6 in. H_2O, then gradually decreased during the climb to approximately -1 in H_2O at 40,000 feet. During push-overs the differential became negative momentarily, then remained near zero during dives. A float installed in the oil tank indicated by a light in the cockpit that the tank was being emptied during climbs. Replacement of the aft oil scavenge pump was ineffective.

g. When the engine was removed for an inspection, another engine was installed for four flights. Zero oil pressure could not be induced on this engine except during negative "g" maneuvers. Turbine frame breather pressure was between -2 and -8 in. H_2O at all times. Oil consumption was less than one quart per hour.

h. During the inspection of engine S/N 042042 the dimensions of both the air and oil seals for No. 4 bearing were found to be out of limits. It was also observed that the mounting surface for the seal was not flat, which caused the seal to be warped upon installation, resulting in wear on one edge of the seal. Since further data were desired on the problem, the seal was not changed.

i. On the theory that the oil was not being properly scavenged because it was being trapped away from the scavenge pump inlet during climbs, two 7/16-inch diameter holes were drilled in the heat shield support cone just forward of the No. 4 bearing (Ref. Fig. 5). This fix proved completely ineffective. Next, a new No. 4 bearing seal was installed; this also was ineffective. After one flight the new seal was out of limits as follows:

	Measurements		Limits	
	Vertical	Horizontal	Min.	Max.
Oil Seal (Before Removal)	6.636 in.	6.641 in.	6.634 in.	6.636 in.
(After Removal)	6.638 in.	6.640 in.	----	----

	Measurements		Limits	
	Vertical	Horizontal	Min.	Max.
Air Seal (Before Removal)	10.760	10.770	10.759	10.762
(After Removal)	- - - -	10.780	10.759	10.762

j. Next, several flights were made with a new turbine frame installed on the engine. Operation was normal in every respect. Oil consumption was about one pint per hour. Two flights were made with the oil supply reduced six quarts, and operation was still satisfactory. The last flights were made with the original bearing seal installed; oil consumption was approximately five quarts per hour, but operation was otherwise satisfactory. Comparative data obtained during climbs with the various configurations are presented in Figures 6 and 7.

k. Inspection of the original turbine frame disclosed extensive cracks in the inner circumferential weld just forward of the No. 4 bearing housing (Ref. Fig. 5). Apparently, air flow through these cracks prevented the oil from reaching the aft scavenge pump inlet. During climbs, when most of the oil would normally flow toward the aft inlet this blocking effect at the aft inlet ultimately caused the oil tank to be emptied.

4. Conclusions:

a. The power loss phenomenon was caused by air being pumped into the fuel regulator as a result of inadequate oil scavenging and the limited oil supply in the F-86E airplane. The cracked turbine frame was directly responsible for the poor oil scavenging.

b. The high oil consumption resulted from an over-size air-oil seal at No. 4 bearing, which allowed a pressure build-up inside the frame. New seals were cut out rapidly because the seal mounting surface on the frame was warped.

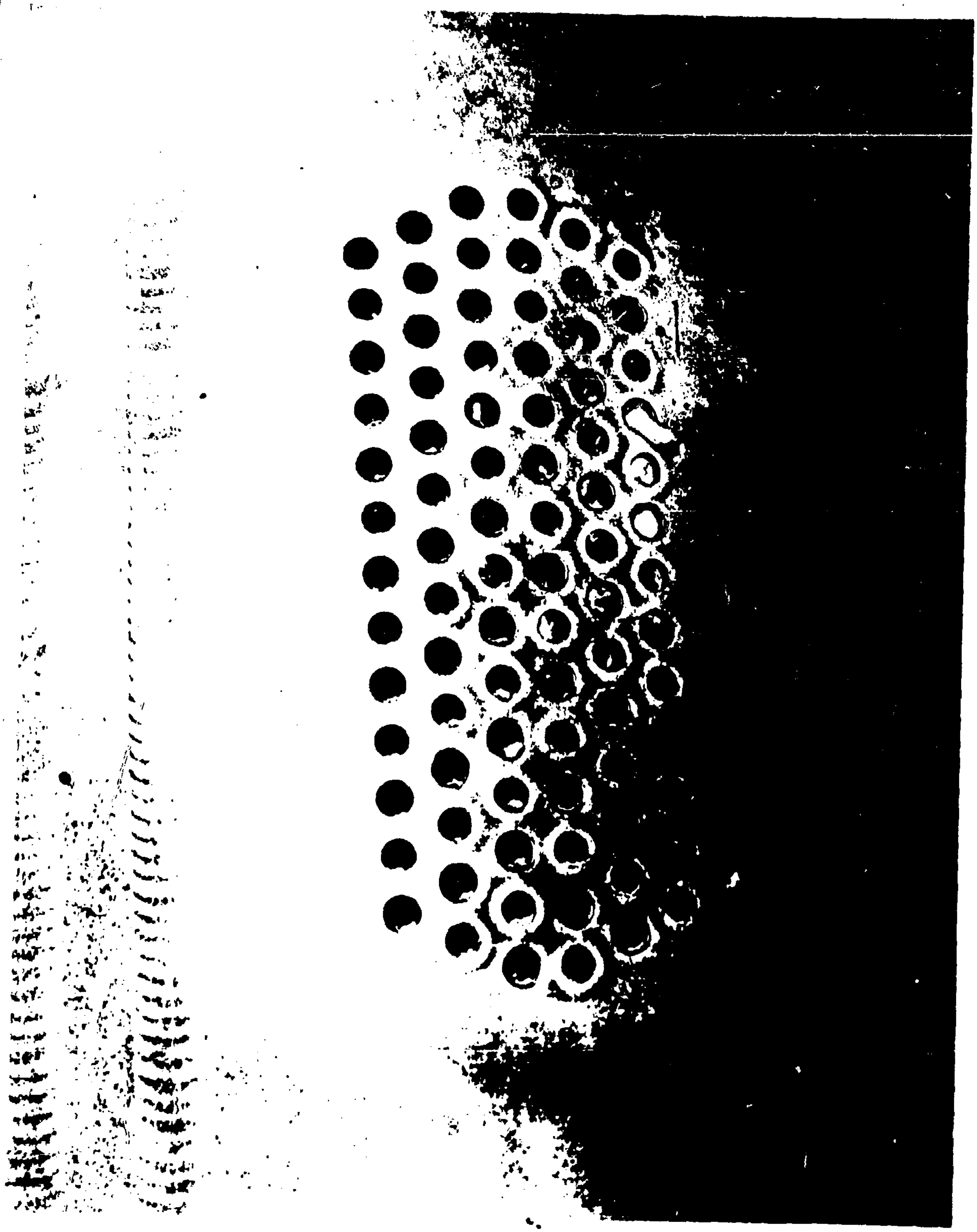

Fig. 1

MOLTEN SEAL METAL IN TEST HOLES, J47-13 ENG. S/N 042764

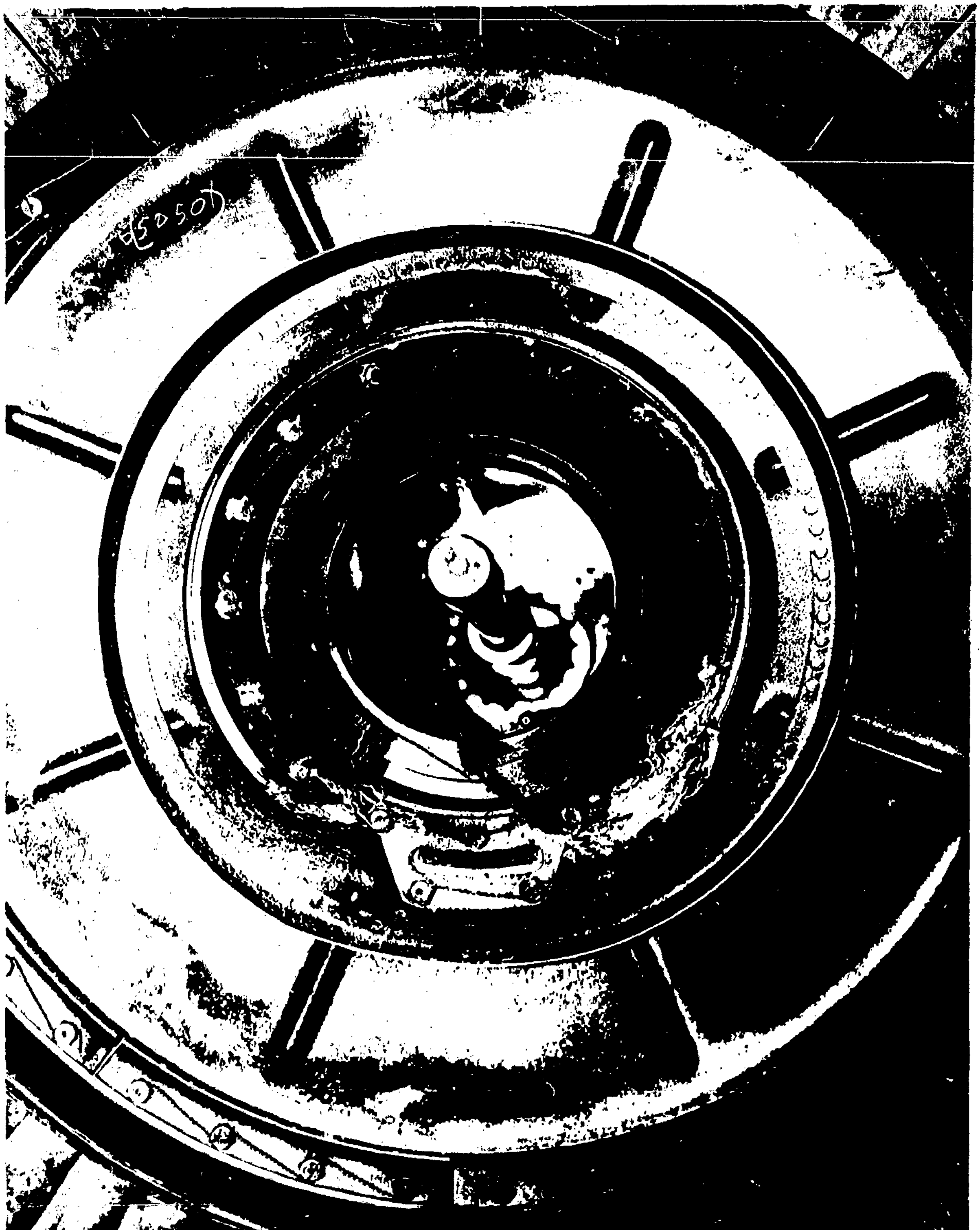

Fig. 2

MELTED NO. 4 BEARING AIR SEAL, J47-15 ENG. S/N 042764

APPENDIX II

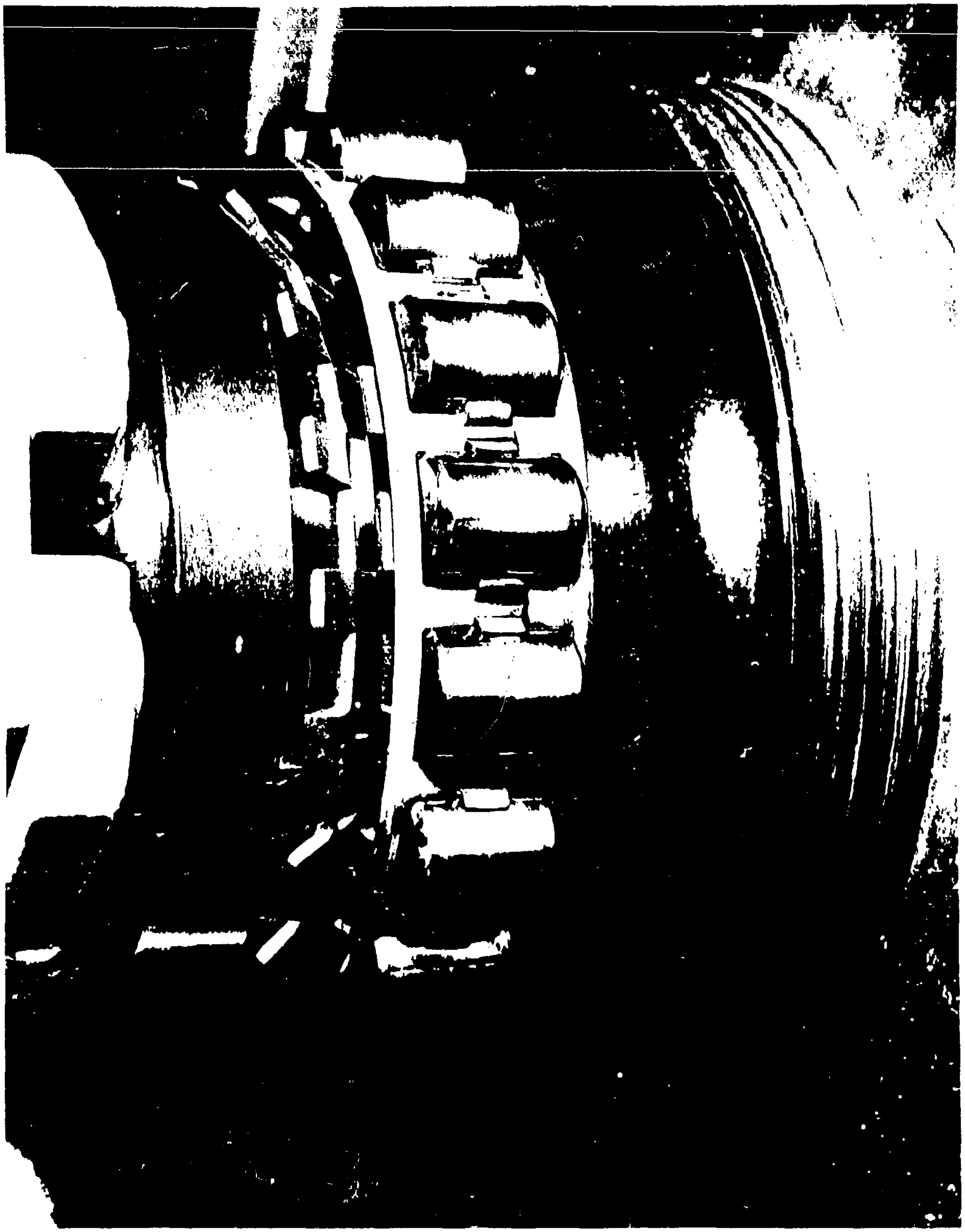

Fig. 3

[illegible] NO. 4 BEARING, J47-15 ENG. S/N [illegible]

Fig. 4
RELOCATED OIL INLET LINE TO FUEL REGULATOR

APPENDIX II

Fig. 5

CRACKED WELD IN TURBINE FRAME, J47-13 ENG. S/N 042042

APPENDIX II

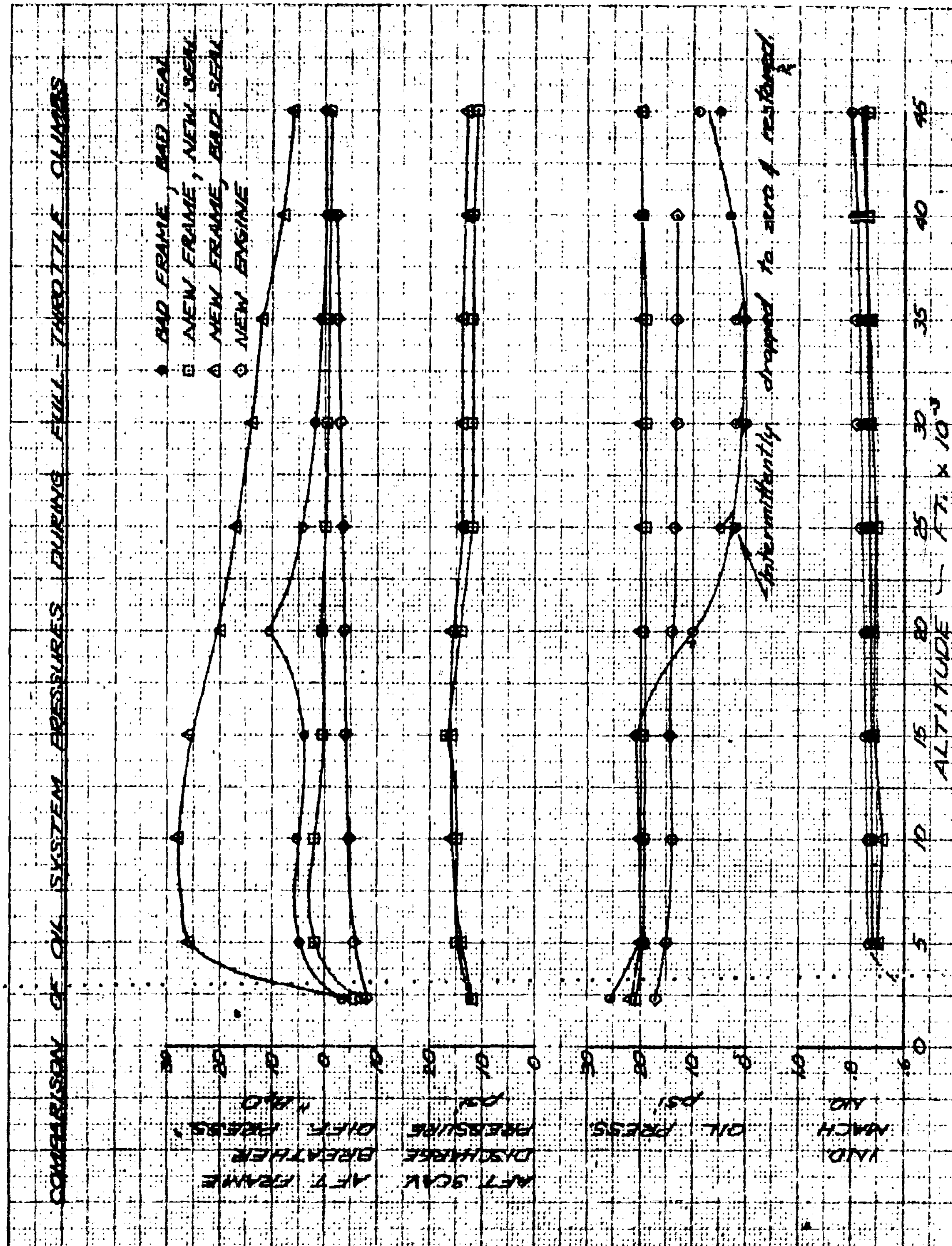

Figure 6
APPENDIX I

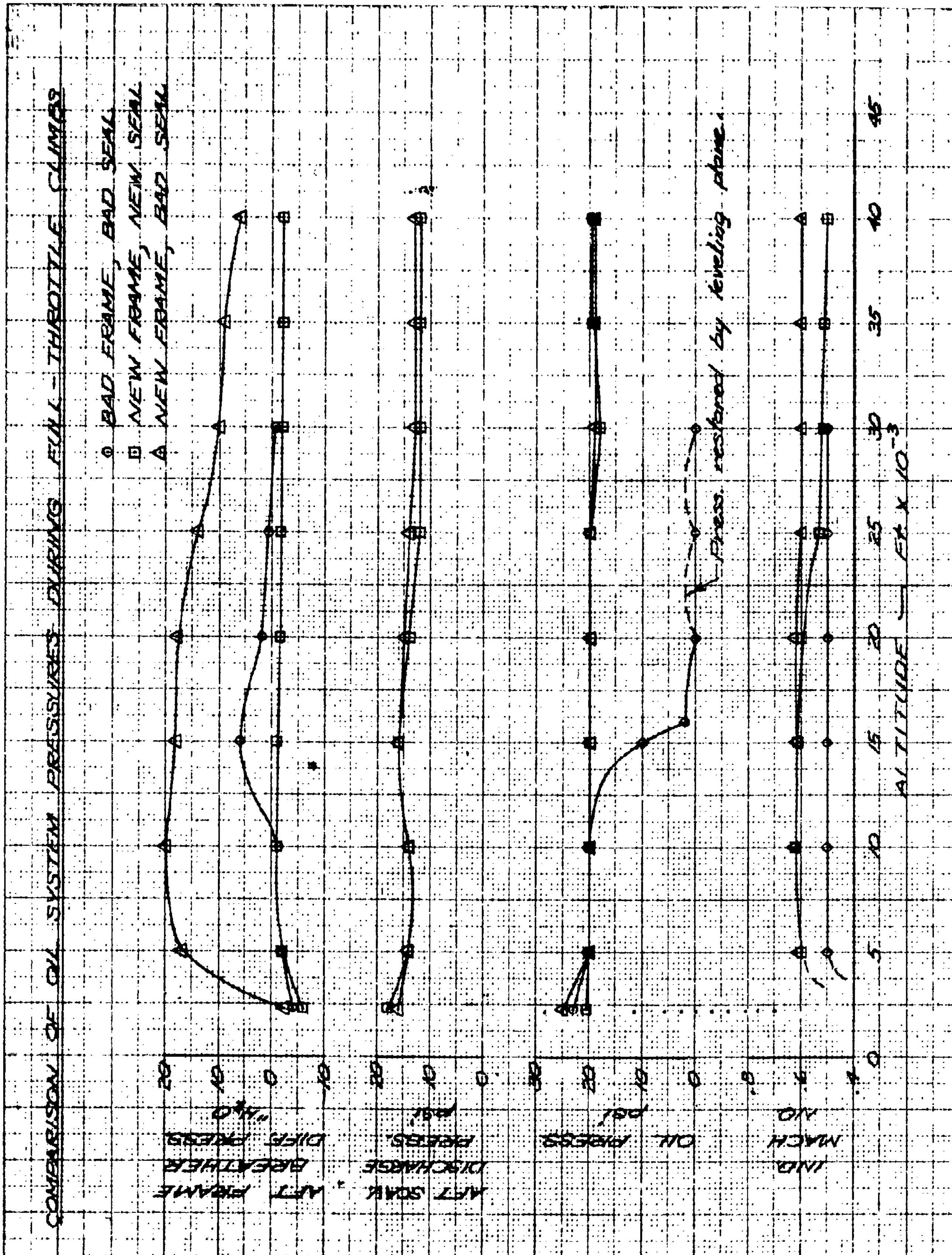

Figure 7

APPENDIX I

AF Technical Report No. AFFTC 53-17

DISTRIBUTION LIST

Activity	No. of Copies
Hq, USAF, Washington 25, D. C.	
Attn: Director of Requirements, DCS/D	1
Attn: Asst for Atomic Energy, Deputy Chief of Staff, Operations	1
Attn: Asst for Programming; Deputy Chief of Staff, Operations	1
Attn: Directorate of Operations; Deputy Chief of Staff, Operations	4
Attn: Directorate of Procurement and Production Engineering, Production Engineering Division	1
Attn: Directorate of Maintenance Engineering	2
Attn: Aircraft Division	1
Hq, AMC, Wright-Patterson AFB, Ohio	
Attn: MCMRM, Materiel and Flight Safety Deficiency Branch	1
Attn: MCSEB, Directorate of Supply and Services	1
Attn: MXMZ, Programs Monitoring Office Supply, M & S Directorate	1
Attn: MCPBXA, Administration Office, Industrial Resources Division	1
Attn: MCPPA, Aircraft Branch, Procurement Division	2
Attn: MCPPXE, Aeronautical Equipment Section, Procurement Division	1
Comdr, ARDC, P. O. Box 1395, Baltimore 3, Maryland	
Attn: RDDAS	1
Comdr, Hq, WADC, Wright-Patterson AFB, Dayton, Ohio	
Attn: WCY, Assistant Chief of Staff	1
Attn: WCRO, Operations & Plans Office	1
Attn: WCOL-1, Major R. L. Northup	1
Attn: WCOW, Weapons System Div	1
Attn: WCOSI, Technical Info Intelligence Branch	1
Attn: WCOST, Test Requirements Branch	4
Attn: WCTE, Engineering Branch	3
Director, Air University Library, Maxwell AFB, Alabama	1
Commandant, USAF Institute of Technology, Wright-Patterson AFB, Ohio	1
Armed Services Technical Information Agency, Document Service Center, Knott Building, 4th & Main Streets, Dayton 2, Ohio	6

AF Technical Report No. AFFTC 53-17

DISTRIBUTION LIST

Activity	No. of Copies
Office of the Inspector General, USAF Norton AFB, San Bernardino, California	3
NACA, Liaison Office, Wright-Patterson AFB, Ohio	
Attn: MOLANA	1
NACA, P. O. Box 273, Edwards, California:	
Attn: Mr. Walter C. Williams, High Speed Flight Research Station	1
Joint Tactical Air Support Board, Fort Bragg, North Carolina	
Attn: ASBM	1
Hq Air Training Command, Scott AFB, Illinois	1
Comdr, Hq WADC, Wright-Patterson AFB, Ohio	
Attn: WCOWF, Fighter Aircraft Branch	2
Hq AFFTC	
Attn: FTDTS-2	1
Attn: FTDA	5
Attn: FTO	1
Attn: FTAH, Base Historian	1
Attn: FTOT	1
Attn: Project Engineer	1

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE MATERIEL COMMAND
WRIGHT-PATTERSON AIR FORCE BASE OHIO

FEB 19 2002

MEMORANDUM FOR DTIC/OCQ (ZENA ROGERS)
8725 JOHN J. KINGMAN ROAD, SUITE 0944
FORT BELVOIR VA 22060-6218

FROM: AFMC CSO/SCOC
4225 Logistics Avenue, Room S132
Wright-Patterson AFB OH 45433-5714

SUBJECT: Technical Reports Cleared for Public Release

References: (a) HQ AFMC/PAX Memo, 26 Nov 01, Security and Policy Review, AFMC 01-242 (Atch 1)

(b) HQ AFMC/PAX Memo, 19 Dec 01, Security and Policy Review, AFMC 01-275 (Atch 2)

(c) HQ AFMC/PAX Memo, 17 Jan 02, Security and Policy Review, AFMC 02-005 (Atch 3)

1. Technical reports submitted in the attached references listed above are cleared for public release in accordance with AFI 35-101, 26 Jul 01, *Public Affairs Policies and Procedures*, Chapter 15 (Cases AFMC 01-242, AFMC 01-275, & AFMC 02-005).

2. Please direct further questions to Lezora U. Nobles, AFMC CSO/SCOC, DSN 787-8583.

Lezora U. Nobles

LEZORA U. NOBLES
AFMC STINFO Assistant
Directorate of Communications and Information

Attachments:
1. HQ AFMC/PAX Memo, 26 Nov 01
2. HQ AFMC/PAX Memo, 19 Dec 01
3. HQ AFMC/PAX Memo, 17 Jan 02

cc:
HQ AFMC/HO (Dr. William Elliott)

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE MATERIEL COMMAND
WRIGHT-PATTERSON AIR FORCE BASE OHIO

DEC 19 2001

MEMORANDUM FOR HQ AFMC/HO

FROM: HQ AFMC/PAX

SUBJECT: Security and Policy Review, AFMC 01-275

1. The reports listed in your attached letter were submitted for security and policy review IAW AFI 35-101, Chapter 15. They have been cleared for public release.

2. If you have any questions, please call me at 77828. Thanks.

JAMES A. MORROW
Security and Policy Review
Office of Public Affairs

Attachment:
Your Ltr 18 November 2001

18 December 2001

MEMORANDUM FOR: HQ AFMC/PAX
Attn: Jim Morrow

FROM: HQ AFMC/HO

SUBJECT: Releasability Reviews

1. Please conduct public releasability reviews for the following attached Defense Technical Information Center (DTIC) reports:

   a. *Emergency Fuel Selector Valve Test on the J47-GE-27 Engine as Installed on F-86F Aircraft*, January 1955; DTIC No. AD- 056 013.

   b. *Phase II Performance and Serviceability Tests of the F-86F Airplane USAF No. 51-13506 with Pre-Turbine Modifications*, June 1954; DTIC No. AD- 037 710.

   c. *J-47 Jet Engine Compressor Failures*, 7 April 1952; DTIC No. AD- 039 818.

   d. *Evaluation of Aircraft Armament Installation (F-86F with 206 RK Guns) Project Gun-Val*, February 1955; DTIC No. AD- 056 763.

   e. *A Study of Serviced-Imposed Maneuvers of Four Jet Fighter Airplanes in Relation to Their Handling Qualities and Calculated Dynamic Characteristics*, 15 August 1955; DTIC No. AD- 068 899.

   f. *Fuel Booster Pump*, 6 February 1953; DTIC No. AD- 007 226.

   g. *Flight Investigation of Stability Fix for F-86F Aircraft*, 8 September 1953; DTIC No. AD- 032 259.

   h. *Investigation of Engine Operational Deficiencies in the F-86F Airplane*, June 1953; DTIC No. AD- 015 749.

   i. *Operational Suitability Test of the T-160 20mm Gun Installation in F-86F-2 Aircraft*, 29 April 1954; DTIC No. AD- 031 528.

   j. *Engineering Evaluation of Type T 160 Gun and Installation in F 86 Aircraft*, September 1953; DTIC No. AD- 019 809.

AFMC 01-275

k. *Airplane and Engine Responses to Abrupt Throttle Steps as Determined from Flight Tests of Eight Jet-Propelled Airplanes*, September 1959; DTIC No. AD-225 780.

l. *Improved F-86F: Combat Developed*, 28 January 1953; DTIC No. AD- 003 153.

m. *Flight Test Progress Report No. 19 for Week Ending February 27, 1953 for Model F-86F Airplane NAA Model No. NA-191*, 5 March 1953; DTIC No. AD-006 806.

2. These attachments have been requested by Dr. Kenneth P. Werrell, a private researcher.

3. The AFMC/HO point of contact for these reviews is Dr. William Elliott, who may be reached at extension 77476.

John D. Weber
JOHN D. WEBER
Command Historian

13 Attachments:
a. DTIC No. AD- 056 013
b. DTIC No. AD- 037 710
c. DTIC No. AD- 039 818
d. DTIC No. AD- 056 763
e. DTIC No. AD- 068 899
f. DTIC No. AD- 007 226
g. DTIC No. AD- 032 259
h. DTIC No. AD- 015 749
i. DTIC No. AD- 031 528
j. DTIC No. AD- 019 809
k. DTIC No. AD- 225 780
l. DTIC No. AD- 003 153
m. DTIC No. AD- 006 806